

## CAMERA MODULE

### BACKGROUND OF THE INVENTION

#### Field of the Invention:

This invention relates to a camera module, specifically to a small size camera module  
5 suitable to be incorporated into a portable device such as a mobile phone.

#### Description of the Related Art:

A mobile phone with camera function has come into widespread use in recent years.  
This type of mobile phone incorporates a small size camera module. Fig. 3 is a cross-sectional  
view showing a structure of such a camera module.

10 Fig. 3 shows a lens-barrel 50, a lens 51 mounted inside the lens-barrel 50 and an IR filter  
52 attached to a mouth of the lens-barrel 50 to block infrared radiation. It also shows an image  
sensor chip 60 housed in a space within the lens-barrel 50 and electrically connected with a  
printed circuit board 70.

The image sensor chip 60 converts light incident from a photogenic subject through the IR  
15 filter 52 and the lens 51 into electric signals. In the image sensor chip 60, a supporting glass  
substrate 62 is bonded to a thin silicon chip 61, in a surface of which CCDs (Charge Coupled  
Devices) are formed.

Each of redistribution wirings 64A and 64B is formed to extend from each of electrode  
pads 63A and 63B, which are formed on a peripheral surface of the image sensor chip 60, over a  
20 side surface and to a back surface of the silicon chip 61. Each of the redistribution wirings 64A  
and 64B extends onto a glass substrate 65 which is bonded to the back surface of the silicon chip  
61. Each of bump electrodes 66A and 66B is formed on an end of each of the redistribution  
wirings 64A and 64B extended onto the glass substrate 65. The bump electrodes 66A and 66B  
are connected to the printed circuit board 70.

25 A DSP (Digital Signal Processor) 80, which performs video signal processing on the  
electric signals from the image sensor chip 60, is connected to a back surface of the printed  
circuit board 70 through bump electrodes 81A and 81B.

In the camera module described above, the lens-barrel 50, the lens 51, the IR filter 52 and  
the image sensor chip 60 are discrete components, and the camera module is assembled by  
30 putting these discrete components together. This causes difficulty in reducing the size and  
production cost of the camera module.

## SUMMARY OF THE INVENTION

The invention provides a camera module that includes an image sensor chip including a semiconductor chip having a photoelectronic transducer formed on a surface of the semiconductor chip and a filter portion disposed on the photoelectronic transducer so as to block light incident on the filter portion at a predetermined range of wavelength, and a lens disposed above the image sensor chip.

## BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a cross-sectional view showing a camera module according to an embodiment of this invention.

Fig. 2 is a cross-sectional view showing a camera module according to another embodiment of this invention.

Fig. 3 is a cross-sectional view showing a conventional camera module.

## DETAILED DESCRIPTION OF THE INVENTION

An embodiment of this invention will be described in detail, referring to the figures. Fig. 1 is a cross-sectional view showing a structure of a camera module according to the embodiment of this invention. The same symbols are assigned to the same components in Fig. 1 as in Fig. 3, and explanations of them are omitted.

CCDs, which are photoelectronic transducers, are formed in a surface of a silicon chip 61 of an image sensor chip 60. An IR filter 90 is bonded to the silicon chip 61 with an adhesive to cover the CCDs. The IR filter 90 corresponds to the supporting glass substrate 62 to support the thin silicon chip 61 shown in Fig. 3, and has a filtering function in addition to a function to support the silicon chip 61. In other words, the IR filter 90 also serves as the supporting glass substrate 62. The IR filter 90 is obtained by vacuum deposition of metal on a glass material or incorporating copper particles into a glass material. Or, a plastic material, a surface of which has a grating structure to provide a filtering function, may be used as the IR filter 90. A single substrate provides both the filtering function and the chip-supporting function.

When forming the IR filter 90 by vacuum deposition of metal on the glass material, the vacuum deposition may be made before or after bonding the glass material to the surface of the silicon chip 61.

The IR filter 90 which blocks infrared radiation is used in an example described above. Instead, an infrared radiation pass filter, which blocks radiation other than the infrared radiation,

may be used when the image sensor chip 60 is an infrared radiation image sensor chip.

Even when the function as the supporting substrate is not required, production cost can be reduced by forming the IR filter 90 on a wafer with a semiconductor wafer processing. For example, various kinds of filters (including IR filter 90) can be formed on a wafer, in which  
5 CCDs are formed, by forming a silicon oxide film (a kind of glass) by CVD (Chemical Vapor Deposition) or forming a SOG (Spin-On Glass) film (also a kind of glass) by coating, planarizing the silicon oxide film or the SOG film by CMP (Chemical Mechanical Polishing) and vacuum  
deposition of metal on the film.

The image sensor chip 60 shown in Fig. 1 has bump electrodes 66A and 66B on its back  
10 surface. Also an image sensor chip 100 without bump electrodes as shown in Fig. 2 may be used. That is, the image sensor chip 100 has a silicon chip 101, in a surface of which CCDs are formed, IR filter 102 formed to cover the surface of the silicon chip 101 and electrode pads 103A and 103B formed on a peripheral surface of the silicon chip 101. The electrode pads 103A and 103B are connected to a printed circuit board through bonding wires 104A and 104B. The IR  
15 filter 102 is formed after the electrode pads 103A and 103B are formed by wafer processing as described above. The IR filter 102 is removed from regions on the electrode pads 103A and 103B.

With this invention, size and cost of the camera module are reduced by forming the filter material to cover the surface of the silicon chip of the image sensor chip.